November 9, 2017

BY ECFS

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: **Elefante Group Notice of Oral *Ex Parte* Presentation; GN Docket No. 14-177, IB Docket Nos. 15-256 and 97-95, and WT Docket Nos. 10-112 and 10-153**

Dear Ms. Dortch:

The Elefante Group, Inc., ("Elefante Group") hereby submits its support for the conclusions reflected in the Public Draft of the Memorandum Opinion and Order ("Draft MO&O") in the above-referenced proceeding to not allow mobile or indoor unlicensed operations in the 71-76 and 81-86 GHz bands (the "70 GHz band" and "80 GHz band," respectively)[1] and responds to the 70 GHz band coexistence analysis presented into the record by Nokia on July 14, 2017.[2] As explained herein, the Commission should preserve the 70 and 80 GHz bands for existing and emerging fixed services, including feeder links for stratospheric-based communications solutions, such as those Elefante Group plans to deploy. Further, the *Nokia Analysis* relied heavily upon overly narrow assumptions that fail to reflect the full range of realistic deployment scenarios, both for mobile services as well as ground-based fixed services. Although the *Nokia Analysis* describes passive and active mitigation techniques, the practicality of implementing such techniques in varying geographic areas and for future services is unclear. As such, the merits of the *Nokia Analysis* are themselves questionable. The *Nokia Analysis* is rendered even less useful in considering coexistence with emerging fixed services that plan to use the 70 GHz band, such as stratospheric communications solutions in light of analyses conducted by Elefante Group.

In its September 8, 2017 *ex parte* submission in this proceeding,[3] Elefante Group is concertedly working with Lockheed Martin Corporation ("Lockheed Martin") to design and

---

1 *In the Matters of Use of Spectrum Bands above 24 GHz for Mobile Radio Services*, Public Draft of Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, GN Docket No, 14-177, *et al.*, ¶¶ 193-194 and 199-200 (Oct. 26, 2017) ("Draft Second Report and Order" and "Draft MO&O" depending on reference).

2 Attachment to Letter from Jeffrey A. Marks, Nokia, to Marlene S. Dortch, Secretary, Federal Communications Commission ("Nokia Letter"), GN Docket No. 14-177; IB Docket Nos. 15-256 and 97-95; RM-11664; WT Docket No. 10-112 (filed July 14, 2017) ("Nokia Analysis").

3 Notice of *ex parte* Presentations to the Office of Engineering and Technology from Edward A. Yorkgitis, Jr. and Joshua Guyan, Kelley Drye & Warren, LLP, Counsel for Elefante Group, to Marlene S. Dortch, Secretary,

develop a persistent stratospheric-based communications and infrastructure. Elefante Group plans to deploy its stratospheric airships in the next several years which will help advance many of the Commission's and the Administration's objectives that are not achievable solely through other existing and planned terrestrial and satellite-based solutions. Elefante Group and Lockheed Martin have been designing for high spectral efficiency and compatibility from the outset in the bands in which Elefante Group's stratospheric platform-based communications systems will operate. The Elefante Group solution is being designed to achieve a throughput of 1 Tbps per platform for communications between the platform and user terminals at the time of launch of commercial operations. Future growth in capacity is planned, leveraging a variety of methods. As explained in the *September 8 Letter*, the Elefante Group, in support of the platform-user terminal communications, intends to deploy feeder links in the fixed services in the 70 GHz and 80 GHz bands.[4] To meet the considerable capacity requirements necessary to support 1 Tbps of throughput between platform communications and user terminals, Elefante Group anticipates there will be need for 10-20 feeder links per platform, each using the entire ten gigahertz of the 70 and 80 GHz bands.

To allow the existing fixed services in the 70 and 80 GHz bands to continue their growth, and to support emerging fixed services, such as those Elefante Group intends to provide, Elefante Group submits that the Commission should not authorize flexible mobile use in these bands as suggested in the *Further Notice of Proposed Rulemaking* in the above-captioned matter. Accordingly, Elefante Group supports action by the Commission, as suggested in the *Draft MO&O* to not allow mobile operations in the 70 and 80 GHz band, noting the 3.25 gigahertz of spectrum made available for flexible use in the Report and Order in Docket 14-177 in July 2016 and the additional 1.7 gigahertz that the Draft Second Report and Order would make available.[5] So as to promote further investment in fixed service deployment in these bands, which the *Draft MO&O* recognizes is likely to play an important role in 5G deployment, the Commission should not qualify its action by characterizing it as a decision made "at this time." Rather, the Commission should remove such phrasing in its final Memorandum Opinion and Order to create a certain environment for the fixed services. As the *Draft MO&O* acknowledges, "[i]t is

---

Federal Communications Commission, GN Docket Nos. 17-183, 14-177, IB Docket Nos. 17-95, 15-256, 97-95, 16-408, RM-11-664, and WT Docket No. 10-112 (filed September 8, 2017) ("September 8 Letter").

4 *Id.* at 8.

5 *Draft MO&O*, ¶¶ 193-194. Similarly, the Commission should decline to authorize expanded unlicensed operations in the 70 or 80 GHz bands. *See id.* ¶¶ 199-200. The Commission has recently made more than 14 gigahertz of spectrum available for unlicensed uses in the millimeter wave spectrum – in the 57-71 GHz band and the 95 GHz band. In light of this extremely generous allocation of frequencies for the development of unlicensed devices and applications, there is no current need to make even more spectrum available for unlicensed use, particularly if there is any potential for increased interference, including interference from an increase in the noise floor, to operations in the 70 and 80 GHz bands. As such, Elefante Group supports the adoption of the decision proposed in the *Draft MO&O* insofar as it would decline rights for deployment of unlicensed devices in the 70 and 80 GHz bands.

important not only to protect existing links but also to provide an opportunity for future growth of fixed service in these bands as demand for backhaul and other related services increases."[6]

In the *Nokia Analysis*, Nokia attempts to make a case for the potential successful coexistence of mobile operations in the 70 GHz band with fixed uses in the band. Nokia claims that its analysis demonstrates "that the typical geometry of deployments of incumbent fixed use and proposed mobile use (including, respective antenna heights and tilt angles), passive mitigation techniques such as strategic location of base stations, as well as active mitigation techniques combine to alleviate interference concerns between proposed 70 GHz mobile services and incumbent fixed services."[7]

In its review of the *Nokia Analysis*, Elefante Group, supported by Lockheed Martin, observed a number of places where the analysis reflected restrictive assumptions about current fixed service and future mobile services that do not reflect the range of real world installations. Operations constrained by these assumptions would not only limit the use of existing fixed services but severely circumscribe future use of this band by emerging fixed services in anticipated deployments, such as Elefante Group's planned high-capacity gateway feeder links between ground-based gateway terminals and the nominally fixed platforms of the Elefante Group airship fleet.

In general, the *Nokia Analysis* strongly relies on geometric diversity between current fixed service point-to-point stations *versus* future mobile service deployments. The assumptions in the *Nokia Analysis* of what fixed service deployments look like are unnecessarily rigid and would tend to preclude what is currently possible under the rules – even leaving aside the type of planned feeder link deployments for stratospheric platform-based solutions. Moreover, were constraints imposed on fixed service deployments, such as those assumed in the *Nokia Analysis*, the usefulness of the 70 GHz band for fixed services would be substantially compromised, especially in many major metropolitan and rural areas. Further, the geometry and service requirements for Elefante Group-type feeder links vary from current fixed service systems assumed in the *Nokia Analysis* in several ways. For example, each Elefante Group airship platform will operate at approximately a 19.5 km altitude, and feeder link gateway terminals will be located within a radius of 20 km of the center of the platform's coverage area. As a result, the corresponding feeder link gateway elevation angles will vary between 45 and 90 degrees versus the low elevation angles assumed for fixed services in the *Nokia analysis*.[8] Elefante Group's system is ideally suited for underserved suburban areas, as well as rural areas, where blockage

---

6 *Id.*, ¶ 193.

7 *Nokia Letter* at 1.

8 It should be noted that the geometry of Elefante Group Feeder Links is compatible with existing and future fixed services due to the narrow beams of both sets of users in the 70 and 80 GHz bands, flux density limitations and with the use of appropriately defined separation distances.

from buildings that might attenuate 5G mobile signals generally can be assumed far less prevalent in comparison with urban deployments.

Several examples of more specific flaws in the *Nokia Analysis* with regard to current ground-based Fixed Service deployments are noted below:

1) The *Nokia Analysis* (at p. 5) assumes that fixed service receivers are higher than mobile cell sites (*i.e.*, greater than 12 meters) but also acknowledges that five percent (5%) of the current fixed service receivers in Los Angeles, for example, are less than 2 meters high. This is expected to be typical of most urban centers,[9] meaning that the *Nokia Analysis* does not take into account a significant segment of fixed service links that would lack the requisite geometric diversity with mobile links to ensure compatibility.

2) The *Nokia Analysis* (p. 6) asserts that fixed services link tilt angles in the urban areas reviewed are predominantly within ten degrees of the horizontal. The Lincoln Park simulation shown at pp. 10-19 of the *Nokia Analysis* utilizes 5G user equipment ("UE") tilt angles between 2 and 24 degrees, which are within or close to the typical elevation angles for current fixed service links. Indeed, for less densely populated areas, with fewer tall buildings, it is much more likely that the tilt angle for 5G transmitting signals will be more closely matched with current fixed service station tilt angles with a corresponding increase in harmful interference, something for which the *Nokia Analysis* fails to account.

3) The Lincoln Park simulation results (p. 13) rely heavily on signal attenuation provided by buildings but a similar degree of blockage is far less likely to exist in less densely populated and rural areas, thus significantly increasing the potential interference impact in those scenarios.

4) Regarding the Lincoln Park simulation (p. 14), the assumptions regarding Access Point ("AP") heights (6 m), UE heights (1.5 m) and implicitly the ground being flat may be reasonable assumptions for Lincoln Park, however, these characteristics do not representative of the range of possible geometries in other locations. A more realistic range of possible configurations would yield a greater range of tilt angles for mobile links and a greater potential impact on current "typical" fixed service deployments, as well as emerging service deployments, such as Elefante Group's feeder link receivers on airborne platforms.

5) The Lincoln Park simulation (p. 14) assumes that the UE azimuth pointing angle is random between 0 and 360 degrees which may be appropriate for statistical interference analysis shown in the *Nokia Analysis*. However, in real world 5G mobile system deployments, all UE's will be pointed to Aps, so a large number of UEs that are located near each other could be pointing directly towards a victim fixed service receiver thus severely impacting its

[9] Many urban cores require siting of base stations on tall structures to serve demand which results in highly inclined geometries, something which is not reflected in the *Nokia Analysis*.

performance.[10]

In order to further assess compatibility of 5G mobile services described in the *Nokia Analysis* with other emerging fixed service applications, services such as Elefante Group's planned high capacity airborne platform system which the *Draft MO&O* acknowledges, Elefante Group performed compatibility analyses with Elefante Group-type feeder links and hypothetical mobile operations under various assumptions. The general conclusion is that the 5G mobile system described in the *Nokia Analysis* would insufficiently constrain transmission of UEs at high tilt angles in outdoor environments and the resultant interference would severely handicap the deployment of feeder links to support Elefante Group and any similar fixed airborne operations in the 70 and 80 GHz bands. Further details of the analyses performed are summarized below.

5G UE Interference into Feeder Uplink to Airship – Single-Entry Analysis

A bounding single-entry analysis indicates that if a single 5G UE is located within 0.5 km of an Elefante Group-type gateway terminal and pointed toward the airship, then the resultant interference from the UE transmitting across one gigahertz of bandwidth would corrupt the vital feeder link serving up to five 250 megahertz platform-user terminal channels of traffic across the entire 70 km radius coverage area of a stratospheric airship platform.[11] The interference from a single UE transmitter in line-of-sight with a platform receiver would result in an interference level 26 dB higher than the thermal noise level. Therefore there would be 20 dB negative margin relative to a -6 dB I/N protection criteria which would completely disrupt feeder link and impact all associated users.[12]

---

[10] Passive mitigation techniques are cited in the Nokia Analysis for existing fixed station receiver deployments. However, many UEs pointing the same direction across multiple cell sites could not take advantage of those same techniques to prevent interference into Elefante Group's feeder link receiver in the airborne platform.

[11] This is particularly significant because, as explained in the *September 8 Letter*, through intense frequency reuse, channels are reused as many as 180-to-200 times within the footprint of each platform. *See September 8 Letter* at 5, n. 8.

[12] Elefante Group gateway terminals, as noted above, are expected to be located near the center of the platform coverage area within a range of higher elevation angles (45-90 degrees) which minimizes interference to and from current fixed service terminals. However, since there are no specific constraints on 5G UE elevation angles defined in the Nokia Analysis and some of the examples provided show 5G UE elevation angles between 0 and 55 degrees (Nokia Analysis at 7), such a worst-case interference scenario seems reasonably likely as a statistical matter, particularly in major metropolitan areas where 5G APs may be located on building roof tops. Even if it were possible that some benefits could be gained by assuming blockage from buildings in urban settings, however, it is highly unlikely that such blockage would exist for all 5G UEs, especially when numerous UEs are located within 0.5 km of the Elefante Group gateway stations even in less densely populated and rural. As noted above, even a single UE pointed at an Elefante Group gateway terminal can severely impact our service.

5G UE Interference into Feeder Uplink to Airship – Multiple-Entry Analysis

Elefante Group also performed a multiple-entry statistical analysis under various assumptions for 5G UE tilt angles, density and locations within a stratospheric airship platform's 70 km radius coverage area. In all cases, the 5G UE terminals were assumed to be distributed randomly and no benefit was assumed from building blockage in order to assess the impact of 5G UE terminals located in outdoor environments. For reasons explained earlier, the *Nokia Analysis* assumptions do not reasonably describe the full range of potential and likely deployments of mobile UEs and APs.

Elefante Group conducted an initial analysis which constrained the 5G UE tilt angles similar to those in the Nokia Lincoln Park simulation (*i.e.*, 5G UEs located 10-100 meters from the 5G APs, 5G UE height of 1.5 m, and a 5G AP height of 6 m). Results indicate marginal but acceptable interference up to a density of 500 active 5G UE's per km^2, consistent with existing fixed service analysis shown in the *Nokia Analysis*.

Elefante Group undertook a second analysis without any constraint on 5G mobile system tilt angles as may be implied by the system characteristics described in the *Nokia Analysis*. In this case, some of the 5G UE terminal geometries could be pointed so that they directly transmit into the stratospheric airship platform-based feeder link receiver. This analysis showed that even a low density of one active 5G terminal per two km^2 pointed toward the stratospheric airship platform can result in interference exceeding a protection I/N ratio of -6 dB. The odds of this happening can be improved slightly if no active 5G UE terminals are located within 0.5 kilometer of the gateway terminals serving the stratospheric airship platform.[13]

One can conclude from the above set of analyses that in order for future high capacity, stratospheric systems to coexist with 5G mobile systems, presumably in an effort to ensure greater use of the 70 GHz band, transmission of 5G UE terminals at higher tilt angles and through back lobes must be adequately controlled particularly near the gateway terminals serving the stratospheric airship platform. In particular, line-of-sight events must be avoided. The interference to stratospheric platform-based feeder link communications, such as Elefante Group's, that would result from a line-of-sight event is very similar to interference that 5G systems can cause into current fixed service systems in case of line-of-sight transmissions from UEs at low altitude and low tilt angles. In short, this interference threat effectively precludes compatible mobile use of this fixed services band.

[13] Elefante Group performed a third analysis assuming that the 5G UE terminals were pointed so that only their 50 dB down back lobe transmissions were directed at the Elefante Group feeder link receivers on the airships. The results in this scenario were encouraging in that even a density of 500 active 5G UEs per kilometer meeting this restriction resulted in over 20 dB of margin for the 95th percentile of cases. However, such a scenario is not consistent with the 5G mobile system described in the *Nokia Analysis*

5G UE Interference into Feeder Downlink to Gateway

Elefante Group also performed a bounding single-entry analysis in this scenario that indicates that if a 5G UE is pointed so that it transmits within the Elefante Group-type gateway beam width of 0.6 deg., this can result in interference to stratospheric airship *downlinks* exceeding an I/N protection criteria of -6 dB. Multiple active 5G UEs located within the gateway beam width would proportionally increase the interference. The stratospheric airship platform operator can possibly mitigate such interference by various techniques such as controlling the side lobes of our gateway terminals or by installing them at locations where they would not have direct field of view to 5G UEs.

* * *

Because the potential for interference into the fixed services in the 70 and 80 GHz bands, including existing fixed services deployments and emerging applications, such as Elefante Group stratospheric feeder link solutions, is much greater than the *Nokia Analysis* suggests, Elefante Group supports a Commission decision declining to make available the 70 GHz band for mobile use. Mobile use in those bands would adversely impact the continued growth of the fixed services in those bands and the emerging uses characterized by Elefante Group's proposal, among others. Rather, the Commission should adopt the *Draft MO&O* on this issue and focus attention to flexible mobile use to the bands already made available in the *Report and Order* in the *Spectrum Frontiers* proceeding and those additional 1700 megahertz of frequencies the Public Draft of the Second Report and Order in this proceeding would designate for flexible mobile use.[14]

Respectfully submitted,

William White
Chief Technology Officer
Elefante Group, Inc.

CC: Rachael Bender
Louis Peraertz
Erin McGrath
Kevin Holmes
Umair Javed
Donald Stockdale
Nese Guendelsberger

[14] Elefante Group has no objection to the Commission addressing the issues raised in the *Spectrum Frontiers* proceeding regarding the Fixed Services operating in the 70 and 80 GHz bands in the *Wireless Backhaul* proceeding (Docket 10-153), but the Commission should expeditiously refresh that record and also take up the issue of Elefante Group's proposed use of the *Fixed Services* in those frequencies to support feeder links for its airship platform-to-gateway communications needs.

Dana Shaffer
Charles Mathias
Matthew Pearl
Julius Knapp
Geraldine Matise
Ronald Repasi
Walter Johnston
Jamison Prime
Rashmi Doshi
Michael Ha
Roger Noel
Nicholas Oros
Howard Griboff
Brian Butler
Bahman Badipour
Linda Chang
Joel Taubenblatt
Blaise Scinto
John Schauble